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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/446,144
Filing Date: March 02, 2000
Appellant(s): RUBBIA, CARLO

Michael L. Kenaga
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 9/19/2005 appealing from the Office action
mailed 8/13/2004.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

The following ground(s) of rejection are applicable to the appealed claims:

(10) References of Record

5,160,696	Bowman	11-1992
3,197,375	Borst	7-1965
4,123,497	Ruddock	10-1978

Principles of Nuclear Reactor Engineering, 1955, p. 87-89

A Glossary of Terms in Nuclear Science and Technology, 1957, p.177

The Examiner has included the following two references showing that the materials of the molten salt of Bowman are indeed substantially transparent.

Bi, Li, F, and Be, pp. 505 and 513, Handbook of Chemistry and Physics, The Chemical Rubber Publishing Company, 1961, and

Bi, Li, F, and Be, Neutron Scattering Lengths and cross sections, available @ <http://www.ncnr.nist.gov/resources/n-lengths>, last accessed 11/22/2005

(11) Grounds of Rejection

The following grounds of rejection are numbered in accordance with appellant's grounds of rejection to be reviewed on appeal spanning pages 4 and 5 of the Appeal Brief submitted 9/19/2005.

Please note, Item 5 is not addressed because the rejection in this regard has been withdrawn.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Items 1 and 2. **The specification is objected to under 35 U.S.C. 112, first paragraph, as failing to provide an adequate written description of the invention and as failing to adequately teach how to make and/or use the invention, i.e. failing to provide an enabling disclosure. Some examples are:**

There is no adequate description nor enabling disclosure of the

parameters of the specific operative embodiments of the invention.

Particularly the diffusing medium as set forth on page 3, lines 3+ of the specification discloses impurities present in the diffusing medium that account for a "cloudy effect" that allows for most of the neutrons to be captured by said impurities.

There is no indication of the exact density and ratio of impurities within the diffusing medium. Furthermore it is not seen wherein what constitutes said impurities. Thus without said impurities the diffusing medium cannot function as claimed. That is the transparency of the Appellant's diffusing medium depends on said impurities. Without such knowledge of what constitutes said impurities, their density ratio to each other, density, etc. within the diffusing medium one cannot replicate Appellant's claimed invention.

Additionally Appellant defines the term (neutron) transparency contrary to the established definition in the art. Thus, there is no indication of how and in what manner Appellant ascertains his transparency definition and why this differs from the accepted norm. That is one skilled in the art would not associate elastic scattering only with transparency.

Thus, for the reasons set forth above the examiner has set forth a reasonable and sufficient basis for challenging the adequacy of the disclosure. The statute requires the Appellant itself to inform, not to direct others to find out for themselves; In re Gardner et al, 166 U.S.P.Q. 138, In re Scarbrough, 182 U.S.P.Q. 298. Note that the disclosure must enable a person skilled in the art to practice the invention without having to design structure not shown to be readily available in the art; In re Hirsch, 131 U.S.P.Q. 198.

Items 3 and 4. **Claims 1-9, 12, 17-25, 28 and 31-32 are rejected under 35 U.S.C. 112, first paragraph for the reasons set forth in the section immediately above.**

Claims 1-9, 12, 17-25, 28 and 31-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Item 6. The term "inner buffer region" in claims 1 and 17 is a relative term, which renders the claim indefinite. The term "inner buffer region" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. As is the claims are indefinite.

Item 7. The term "outer buffer region" in claims 5 and 20 is a relative term, which renders the claim indefinite. The term "outer buffer region" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. As is the claims are indefinite.

Item 8. With regard to the term "transparency" the claims are vague, indefinite and incomplete, particularly in regard as to what is meant by and encompassed by the term.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Item 9. Claims 1-9, 12, 17-20, 23-25 and 28 are rejected under 35 U.S.C. 102(b) as being anticipated by Bowman (5,160,696).

Bowman (see entire document) discloses an apparatus capable of meeting Appellant's claimed inventive concept and anticipates the claims.

Referring to figure 4 Bowman discloses a transmutation system wherein a material (actinide waste, fission products, Tc⁹⁹, I¹²⁹ etc.) stored in container (98) is subjected to a neutron flux produced a high-energy particle beam (80) on a spallation target. The exposed material of container (98) is distributed in a first neutron diffusing medium (molten salt) surrounding the neutron source (80), the first neutron diffusing

medium being transparent to the produced neutrons and arranged so that the neutron scattering properties of the diffusing medium substantially enhance the neutron flux originating from the source to which the material exposed. Note here that the molten salt of Bowman contains beryllium (Be) a known neutron multiplier, thus the molten salt of Bowman enhances the neutron flux of the source.

With regard to the distance, occupied by the first diffusing medium, between the neutron source (80) and the exposed material (98) being at least one order of magnitude larger than the diffusion coefficient for elastic neutron scattering with the first diffusing medium it appears inherent that the physical separation of the neutron source (80) and the container (98) provides at the minimum the specified distance.

As to limitations which are considered to be inherent in a reference, note the case law of In re Ludtke, 169 U.S.P.Q. 563., In re Swinehart, 169 U.S.P.Q. 226; In re Fitzgerald, 205 U.S.P.Q. 594., In re Best et al, 195 U.S.P.Q. 430; and In re Brown, 173 U.S.P.Q. 685, 688.

The first diffusing medium of Bowman further provides for the diffusing medium (molten salt) to contain heavy elements (see column 11, lines 22+), thus neutron interactions with said heavy elements would result in slowing energies of the neutrons originating from the neutron source.

Bowman further discloses a deuterated water moderator (44) surrounding a portion of the diffusing medium (molten salt).

Note that Bowman discloses two diffusing mediums. The first medium being the molten salt as set forth above. The second being the liquid metal (Pb-Bi) spallation target being free of exposed material (98) and located between the moderator (44) and the diffusing medium (molten salt).

Additionally note that Bowman further provides for extraction of useful isotopes and the extraction of heat via a heat exchanger/turbine system.

While patent drawings are not drawn to scale, relationships clearly shown in the drawings of a reference patent cannot be disregarded in determining the patentability of claims. See In re Mraz, 59 CCPA 866, 455 F.2d 1069, 173 USPQ 25 (1972).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Item 10. Claims 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bowman ('696) as applied to claims 1-9, 12, 17-20, 23-25 and 28 above and further in view of Borst (3,197,375).

As set forth above Bowman discloses Appellant's inventive concept; however, Bowman does not disclose the use of carbon as a moderating material.

Borst teaches the use of carbon/graphite as a neutron moderating material in the same field of endeavor for the purpose of enhancing nuclear reactions by slowing neutrons to thermal energies in, for example column 1, lines 33+.

Although Borst does not disclose the particular dimensions set forth by Appellant for his moderator it is within the skill level of the ordinary artisan to optimize the moderator to promote the desired end result, i.e. the amount of moderation, etc. Here such would be the transmutation of the exposed material. See MPEP 2144.05 11 (A) - Optimization within the prior art conditions.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the transmutation system of Bowman to have included the carbon/graphite moderator teachings of Borst as such results are in no more than the utilization of conventionally known moderating materials within the nuclear art.

Item 11. **Claims 31-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bowman ('696) as applied to claims above 1-9, 12, 17-20, 23-25 and 28 and further in view of Ruddock (4,123,497).**

As set forth above Bowman discloses Appellant's inventive concept; however, Bowman does not disclose the transmutation of radioisotope Mo⁹⁸ to Tc⁹⁹.

Ruddock teaches the transmutation of Mo⁹⁸ via neutron capture in a nuclear reactor environment in the same field of endeavor for the purpose of producing medically beneficial radioisotope Tc⁹⁹. Ruddock further teaches the exposed material Mo⁹⁸ being in a phosphomolybdate complex salt being in an alumina matrix from which Tc⁹⁹ is extracted. See entire document.

Clearly, transmutation of Mo⁹⁸ by neutron activation is obvious as is evident by the teachings of Ruddock. One skilled in the nuclear art would realize the substitution of one transmutation material for another. That is the substitution of Mo⁹⁸ into the container (98) holding the transmuted material of Bowman would have been obvious to one having ordinary skill in the art at the time the invention was made as such results are in no more than the utilization of conventionally known methods neutron activation within the nuclear art.

(12) Response to Argument

The following responses are numbered in accordance with appellant's arguments beginning on page 5 of the Appeal Brief submitted 9/19/2005. Again, please note, Item 5 is not addressed as the rejection in this regard has been withdrawn.

It appears that a majority of appellant's arguments and basis of appeal are rooted on the definition of "transparent" and what exactly is the "diffusing medium".

Appellant argues that the definition of "transparency" set forth in the specification in one full sentence is clearly defined. That being transparent is meant as the property of a medium in which neutrons undergo mostly elastic scattering (specification page 2, lines 30-32).

The examiner disagrees. Appellant within the specification pages 2-3 sets forth his transparency definition as being two steps, (1) and (2). Appellant correctly sights only part of step (1). Step (1) is further expounded upon on page 3, lines 3+ of the specification wherein Appellant further cites a doping of the diffusing medium making it "cloudy" and consequently allowing for neutron capture by the subject impurities. Neutron capture by Appellant's own definition occurs within the diffusing medium. Therefore the diffusing medium is truly not elastic.

Even if one were to accept Appellant's definition of transparent, there is no adequate description or enabling disclosure of what all is meant and encompassed by the term mostly elastic. The specification provides no relevance of what mostly elastic is construed to be, i.e., 2/3, 5/8, ¾, etc. Mostly only involves greater than ½. However, no standard is set forth by Appellant.

The examiner referring to the definition of transparency (Per A glossary of Terms in Nuclear Science and Technology, 1957 the term transparency is

defined as being to permit the passage of radiation particles) has clearly shown Appellant's definition to not be consistent with that set forth in the art. *That is, no mention of elastic or inelastic scattering is present in the definition* [emphasis added]. Appellant by defining his transparency in relation to elastic scattering has set forth a definition repugnant to the accepted definition within the art. While Appellant may be his or her own lexicographer, a term in a claim may not be given a meaning repugnant to the usual meaning of that term. See In re Hill, 161 F.2d 367, 73 USPQ 482 (CCPA 1947).

Principles of Nuclear Reactor Engineering, sets forth that lead and bismuth (both of Appellant's diffusing medium materials) act like light nuclei with respect to inelastic scattering. That is light nuclei tend to not undergo inelastic scattering; however, there is no standard set forth by Appellant what constitutes mostly elastic scattering, i.e., 2/3, 5/8, ¾, etc. Thus, while hydrogen may undergo no interactions, heavier nuclei in comparison to hydrogen, such as Oxygen do. Likewise lead and/or bismuth also undergo some inelastic scattering. There is no indication what is an acceptable level of inelastic scattering within Appellant's disclosure. Thus, as set forth previously, the specification is insufficient in defining how and in what manner Appellant achieves mostly elastic scattering in his diffusing medium when the prior art indicates that the materials in question (i.e., lead/bismuth), be it slight or great, act as inelastic scatterers.

As set forth above Appellant adds material impurities to his diffusing medium to make it "cloudy". By doing so neutron capture occurs by the subject impurities. Thus, neutron capture is occurring within the diffusing medium. Again as previously set forth inelastic scattering is occurring within Appellant's diffusing medium. That is Appellant's diffusing medium is not mostly elastic scattering and therefore by Appellant's own definition is not substantially transparent.

As before there is no adequate description nor enabling disclosure of the parameters of the specific operative embodiments of the invention. Particularly the diffusing medium as set forth on page 3, lines 3+ of the specification discloses impurities present in the diffusing medium that account for a "cloudy effect" that allows for most of the neutrons to be captured by said impurities. There is no indication of the exact density and ratio of impurities within the diffusing medium. Furthermore it is not seen wherein what constitutes said impurities. Thus without said impurities the diffusing medium cannot function as claimed. That is the transparency of the Appellant's diffusing medium depends on said impurities. Without such knowledge of what constitutes said impurities, their ratio, density, etc. within the diffusing medium one cannot replicate Appellant's claimed invention.

Appellant argues that in the context of the disclosure, it is evident that the "impurities" which "dope" the diffusing medium consist of the material for which exposure to a neutron flux is looked for in the claimed method. Appellant cites

that the increased neutron capture efficiency is achieved with the help of the nature and of the geometry of the medium surrounding the source, in which a small amount of the element to be transmuted ("impurities") is introduced in a diffused way ("doped"). Those skilled in the art immediately understand that what would make the medium "cloudy" in the optical analogy is the isotope in which neutron capture is expected.

The examiner disagrees for the reasons set forth above. No amounts of impurities are set forth. One skilled in the art cannot ascertain such. Appellant's definition of transparency as pointed out above is inconsistent with the accepted meaning. Even Appellants own definition is contradicted. Mostly elastic yet doped to provide inelastic properties.

Lastly in regard to the transparent diffusing medium. It appears now based on Appellant's arguments that only a select few mediums are possible (i.e., lead and/or bismuth). Thus claim 1 appears to be broader than the enabling disclosure as not all transparent medium can be used in Appellant's invention to achieve the desired results. As set forth above one cannot replicate Appellant's claimed invention without knowledge of what constitutes the diffusing medium including the impurities, their ratio, density, etc.

Items 6 and 7. Appellant is correct in that during patent prosecution, the pending claims must be given the broadest reasonable interpretation and as such the terms "inner" and "outer" buffer regions are vague and indefinite. In Appellant's specification and drawings there are two distinct and separate buffers

(Fig. 7a, items 3 and 5). While the buffers can be the same material they are separate. This is evident by the activity volume (thin tubes) located between the two buffer layers. From the specification and drawings (figure 7b, items 12 and 16) there appears to be no intermixing of the two buffers.

The claim language reads on a single buffer having an inner and outer layer or region. Clearly, this is not the same as two separate and distinct buffers having diffusing medium located therein, hence the claims are indefinite as they read on BOTH two separate and distinct buffers (inner and outer) AND a single buffer having an inner and outer region.

Item 8. Again, Appellant is correct in citing the MPEP 2173.05 (a) wherein the specification states the meaning that a term in the claim is intended to have, the claim is examined using that meaning. However, Appellant cites only a portion of the claimed transparency definition. The specification Pages 2-3 disclose two steps (1) and (2). Step (1) (page 3, lines 3+) further cites a doping of the diffusing medium making it "cloudy" and consequently allowing for neutron capture by the subject impurities. Thus, as specified by Appellants own specification neutron capture is occurring within the diffusing medium. Therefore the diffusing medium is truly not elastic.

Per A glossary of Terms in Nuclear Science and Technology, 1957 the term transparency is defined as being to permit the passage of radiation particles. No mention of elastic or inelastic scattering is present in the definition. While Appellant may be his or her own lexicographer, a term in a claim may not

be given a meaning repugnant to the usual meaning of that term. See In re Hill, 161 F.2d 367, 73 USPQ 482 (CCPA 1947).

Item 9. It is not clear how Appellant can perceive Bowman not to read on his claimed inventive concept. The molten salt of Bowman being the first diffusing medium doped with beryllium to enhance neutron multiplication. Therefore, the first diffusing medium of Bowman being substantial transparent to neutrons. That is the first diffusing medium of Bowman is transparent in accordance with the accepted meaning in the art (permit passage of radiation or particles). Bowman's first diffusing medium permits the passage of neutrons to interact with the to be exposed material. Even if Appellant's definition (mostly elastic) were considered to be correct Bowman meets this as well. The first diffusing medium of Bowman being mostly elastic or transparent to neutrons.

On pages 16-17 of the Appeal Brief received 9/19/2005 Appellant attempts to define the molten salt blanket medium of Bowman as incorporating fertile and fissile materials and as such cannot be considered as being "mostly elastic". However for the same reasons as appellant discloses in said 9/19/05 appeal brief on page 8, lines 12-18 it is apparent that it is the exposed material that captures the neutrons and not the diffusing medium itself, i.e. the molten salt.

The Handbook of Chemistry and Physics and "neutron Scattering and cross sections" both teach the properties of the molten salts proposed in Bowman, column 11 lines 38 and 39 and therewithin it is specifically disclosed

that said molten salt is "for the transport of dissolved...into and out of the recirculation loop". Clearly this has parallels to the instant invention's use of molten lead for the same purpose. Both Bowman and the instant invention disperse the material to be exposed to the neutron flux inside the diffusion medium, See for example the specification page 2 lines 8-14. Appellant's attempts to define the blanket material of Bowman as containing fuel material and fertile or fissile materials are equally applicable to his own invention and as such are not persuasive. Again, upon review of the neutron capture cross sections and scattering cross section of the materials of the molten salt (i.e. diffusing medium) of Bowman, it is apparent that the scattering cross section is on the order of about two magnitudes larger than the absorption cross section. For example, according to page 513 of The Handbook of Chemistry and Physics, Bi (Bismuth) has a scattering cross section of $9 +/- 1 \text{ barns}$ while its neutron capture cross section is $34 +/- 2 \text{ mb (millibarns)}$ or $.034 +/- .002 \text{ barns}$, thus the propensity of Bismuth atoms is to "scatter" neutrons instead of "absorb" neutrons, hence it is apparent that said materials are indeed "transparent" to neutrons even by applicant's own definition.

It is noted that the claims do NOT specify any time during operation that said conditions must exist, therefore it is considered that the period of startup of Bowman, before any materials are incorporated into the molten salt, reads on the claim language. Even if the initial startup is not perceived to read on the claim language, the point at which the molten salt has been scrubbed of fission

products and reintroduced into the reactor is considered to read on the claim language.

Although Bowman does not specifically state the use of a "transparent" medium, as defined by the applicant, as explained above, the molten salt of Bowman is indeed transparent and functions in the same manner as the neutron-diffusing medium of the instant invention as the molten salt is simply the "buffer" or "transport medium" for the material to be "transmuted".

Items 10 and 11, Appellant has offered no further arguments except for the base claim, which have already been addressed, therefore no response in this regard is required.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Daniel Lawson Greene Jr.


Conferees:

Jack Keith (SPE 3663) 

Ricardo Palabrica 


JACK KEITH
SUPERVISORY PATENT EXAMINER